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SOME NEW RADIOACTIVE ISOTOPES

by

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In order to allow quantitative interpretation of the reactions of high energy particles from the 184-inch cyclotron with tantalum and heavier elements, a systematic survey is being made of radioactive isotopes of the rare earth elements and hafnium, tantalum, tungsten and rhenium. Bombardments of various elements are being made using 38-Mev and 20-Mev helium ions, 19-Mev deuterons, and 10-Mev protons from the 60-inch Crocker Laboratory cyclotron. Chemical separation of the rare earth elements is made by ion-exchange resin columns. The accompanying table summarizes present data; energies of radiations are determined from absorption measurements; positrons are observed using a "magnetic counter"; mass allocations are made on the basis of measured cross sections.

Detailed accounts of experimental techniques and of the isotopes will be published.

The allocation of the previously reported β active isotopes of lutecium with half-lives of 3.75h and 6.8d, to masses 176 and 177 respectively, has been confirmed by measurement of the d,p cross sections for 19-Mev deuterons on lutecium.

Table 1.

Isotope	Class	Type of radiation	Half-life	Energy of Radiation in Mev particles	γ-Rays	Produced by
Tb^{152}	D	K	4.5h*		K,x-rays	Eu-α-3n
Tb^{153}	D	K,e^-	5.1d	0.15, 0.4	L,K,x-rays	Eu-α-2n
Tb^{154}	D	β^+,K,e^-,γ	17.2h	β^+ 2.6 e^- 0.22,~1	L,K,x-rays 1.4	Eu-α-n Eu-α-3n
Tb^{155}	D	K,e^-	~1y	0.1	L,K,x-rays	Eu-α-2n
Ho^{160}	D	K?	~20m		x-rays	Tb-α-3n
Ho^{161}	B	K,e^-,γ	4.5h	0.3	L,K,x-rays 1.1	Tb-α-2n Dy-p-n
Ho^{162}	B	K,e^-,γ	65d	0.16,0.6	L,K,x-rays	Tb-α-n Dy-d-n,2n,3n Dy-p-n
Ho^{164}	D	β^-	35m	0.7		Dy-p-n
Tm^{166}	B	β^+,K,e^-,γ	7.7h	β^+, 2.1 e^- 0.24,~1	L,K,x-rays ~1.5	Ho-α-3n
Tm^{167}	B	K,e^-,γ	9d	0.21	L,K,x-rays 0.22, 0.95	Ho-α-2n Ta-d-5z-16a
Tm^{168}	B	K?e^-	~150d			Ho-α-3n

Table 1. (continued)

Isotope	Class	Type of radiation	Half-life	Energy of particles	Radiation in Mev γ-Rays	Produced by
Lu^{170}	B	β^+,K,e^-,γ	2.15d	β^+ 1.7 e^- 0.1	L,K,x-rays 1.5	Tm-α-3n Yb-d-2n,3n Ta-d-3z-13a
Lu^{171}	B	K,e^-,γ	9d	0.17, 0.7	L,K,x-rays	Tm-α-2n Ta-d-3z-12a Yb-d-n,2n,3n
Lu^{172}	B	K,e^-,γ	>100d			Tm-α-n Yb-α-n,2n,3n
Ta^{176}	B	K,e^-,γ	8.0	0.12,0.18,1.2 ?	L,K,x-rays 1.7	Lu-α-3n Ta-d-z-7a
Ta^{177}	B	K,e^-	2.66d	0.1	L,K,x-rays	Lu-α-2n Ta-d-z-6a Hf-d-n,2n,3n
Ta^{179}	B	K,e^- or β^-	16d	1.1		Lu-α-n Hf-d-n,2n,3n
Re^{182}	B	K,e^-,γ	64h	0.11,0.27 0.6	L,K,x-rays 0.22, 1.5	Ta-α-3n W-p-n
Re^{183} or 4	C	K,e^-,γ	~ 80d	0.1	L,K,x-rays 1.0	Ta-α-2n W-p-n
Re^{184} or 3	C	K,γ	13h		K,x-rays 1.6	Ta-α-n W-p-n

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